CLAIMS

1. Process for the catalytic polymerization of olefins comprising the steps of;
i) a first polymerization in a first reactor, wherein olefins are polymerized with a particulate catalyst, hydrogen and optional a comonomer in a fluidum of an inert low boiling hydrocarbon medium into an reaction mixture comprising polymerized olefins; and
ii) a second polymerization in a second reactor, wherein the polymerized olefins are further polymerized in a fluidized bed and in a moving bed under such conditions that the residence time in the fluidized bed and the residence time in the moving bed are independently controlled.

2. Process according to claim 1, wherein the inert low boiling hydrocarbon medium comprises propane, butane, isobutane, pentane, hexane, heptane, octane, cyclohexane or cycloheptane.

3. Process according to claim 1 or 2, wherein the first polymerization is carried out in a liquid phase.

4. Process according to any of the claims 1-3, wherein the first polymerization is carried out at a temperature of about 75^0 to 110^0C and a pressure of 40-90 bar.

5. Process according to claim 1, wherein the first polymerization of olefins is carried out under supercritical conditions, wherein the polymerization temperature and pressure are above the corresponding critical points of the mixture formed by the olefins, catalyst, hydrogen, optional comonomer and fluidum of inert low boiling hydrocarbon medium and the polymerization temperature is below the melting point of the formed polymerized olefins.

6. Process according to claim 5, wherein the inert low boiling hydrocarbon is propane.

7. Process according to claim 5 or 6, wherein the first polymerization is carried out at a temperature of about 85^0-110^0C and a pressure of 60-90 bar.

8. Process according to any of the claims 1-7, wherein after the first polymerization at least part of the hydrogen, unreacted reactants and inert low boiling hydrocarbon medium are removed from the reaction mixture.

9. Process according to 8, wherein at least part of the hydrogen and the inert low boiling hydrocarbon are removed from the polymerized reaction mixture by flashing.

10. Process according to any of the claims 1-9, wherein the residence time in the moving bed is independently controlled.

11. Process according to any of the claims 1-10, wherein the residence time in the moving bed is controlled by controlling the outflow rate of particles from the moving bed.

12. Process according to any of the claims 1-11, wherein the moving bed is separated from the fluidized bed by a separation fluidum.

13.Process according to claim 12, wherein the separation fluidum is supplied to the moving bed.

14. Process according to claim 12 or 13, wherein the separation fluidum is a gas or a liquid and selected from the group comprising an inert gas or liquid, such as nitrogen, C_1-C_{12}-alkane or olefins such as C_2-C_{12}-alkylene, or mixtures thereof.
15. Process according to claim 14, wherein the separation fluidum is a liquid evaporating under the residing polymerization conditions.

16. Process according to any of the claims 13-15, wherein liquid olefins are added as separation fluidum such that the polymerization in the moving bed is a condensed mode polymerization.

17. Process according to any of the claims 1-16, wherein liquid olefins are added to the fluidized bed such that the polymerization in the fluidized bed is in a condensed mode polymerization.

18. Process according to any of the claims 12-17, wherein the separation fluidum comprises a polymerization monomer or comonomer, or mixture thereof.

19. Process according to any of the claims 1-18 further comprising a third polymerization carried out in a third reactor.

20. Process according to claim 19, wherein the third reactor is a gas phase reactor.

21 Process according to claim 19 or 20, wherein in the third reactor
the polymerized olefins are further polymerized in a fluidized bed and in a moving bed such that the residence time in the fluidized bed and the residence time in the moving bed are independently controlled.

22. Process according to any of the claims 1-22 comprising a pre-polymerization step.

23.Reactor system for the catalytical polymerization of olefins comprising a first polymerization reactor for carrying out the first polymerization, which first reactor comprises inlets for olefins, catalyst, hydrogen, optional comonomer, and inert low boiling hydrocarbon medium, the first reactor further comprises a product outlet for a reaction mixture comprising polymerized olefins; and wherein the product outlet of the first reactor is connected to an inlet of a second reactor for carrying out the

second polymerization, which second reactor comprises a reactant inlet, a fluidized bed unit, a moving bed unit and a product outlet, wherein the fluidized bed unit comprises means for maintaining a fluidized bed in the fluidized bed unit and wherein the moving bed unit is provided with an inlet directly connected to the fluidized bed unit such that the residence time in the fluidized bed unit and the residence time in the moving bed unit are independently controlled.

24. Reactor system according to claim 23, wherein the first polymerization reactor comprises a loop reactor.

25. Reactor system according to claim 24, wherein the loop reactor is adapted to work under supercritical conditions.

26. Reactor system according to any of the claims 23-25, wherein the product outlet of the first reactor is connected to removal means for removing hydrogen, unreacted reactants and inert low boiling hydrocarbon medium, and wherein the removal means comprise an outlet for polymerized olefins, which outlet is connected to the inlet of the second reactor.

27. Reactor system according to claim 26, wherein the removal means are flashing means.

28. Reactor system according to any of the claims 23-27, wherein the inlet of the moving bed unit is arranged in the fluidized bed unit.

29. Reactor system according to any of the claims 23-28, wherein the outlet of the moving bed unit is connected to the fluidized bed unit.

30. Reactor system according to any of the claims 23-29, wherein the moving bed unit is arranged in, around, adjacent to the fluidized bed unit.

31. Reactor system according to any of the claims 23-30, wherein the moving bed unit is provided with means for supplying a separation fluidum.

32. Reactor system according to any of the claims 23-31, wherein the inlet of the moving bed unit is provided with a diverging section

33. Reactor system according to any of the claims 31 or 32 wherein the outlet of the moving bed unit is provided with means for controlling the outflow rate of particles from the moving bed unit.

34. Reactor system according to any of the claims 23-33, further comprising a pre-polymerisation unit connected to the catalyst inlet of the first polymerization reactor.

35. Reactor system according to any of the claims 23-34, comprising a third reactor for carrying out a third polymerization and connected to the second reactor.

36. Reactor system according to claim 35, wherein the third reactor is a gas phase reactor.

37. Reactor system according to claim 35, wherein the third reactor comprises a reactant inlet, a fluidized bed unit, a moving bed unit and a product outlet, wherein the fluidized bed unit comprises means for maintaining a fluidized bed in the fluidized bed unit and wherein the moving bed unit is provided with an inlet directly connected to the fluidized bed unit such that the residence time in the fluidized bed unit and the residence time in the moving bed unit are independently controlled.

38. Reactor system according to any of the claims 23-27 comprising a pre-polymerisation reactor.

39. Use of a reactor system according to any of the claims 23-38 for the catalytic polymerization olefins

40. Polyolefins obtainable by the process according to any of the claims 1-22.

41. Use of polyolefins according to claim 40 in pipes, blow molded articles, coating of metal pipes, jacking of cables, extrusion coating, films and insulation layers of cables.